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ONLINE MONITORING AND TRANSFERING OF GEOLOGICAL GASES DATA THROUGH ZIGBEE

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ABSTRACT

Global warming is making all the Scientists, Engineers and Doctors to think and act in each and every movement. A predictable rise on the Earth's temperature is mainly due to the carbon dioxide levels exceeding the pre-industrial threshold levels, which in turn is effecting the global climate atmospheric concentrations. The monitoring of these gases is very important for effective control of the atmosphere pollution levels to a permissible limit. The data obtained from the sensors are transferred to the receiver side through Zigbee communication. The main purpose of this paper is to implement a control system which will keep a track of the concentration of different gases, and would alert the higher authorities or control engineers in case the concentration goes above the set threshold levels. Sensor's resistance would change depending upon the concentration of the gas, which will change the voltage. This change can be tracked by the microcontroller to convert the analog data into digital data, and transfer it wirelessly to the base module.

KEYWORDS: Arduino, Benzine, Carbon Monoxide, Gas Sensors, Zigbee

INTRODUCTION

In our daily life, environment plays a most significant impact on health issues. Therefore, environment and industry air quality issues are critically regarding the threat on the environment towards public and industrial workers health. Most of the dangerous gas such as carbon monoxide (CO), refrigerant gas and liquefied petroleum gas (LPG) is colorless and odorless compound that are produced by incomplete combustion. Injurious gas Carbon monoxide (CO) is a "silent killer". CO is commonly emitted due to fires, burning of chemical materials or decorative materials. To inform the safety situations from time to time a gas detector and warning system is required. It continuously monitors and detects the concentration of these gases and intimates the same to remote places once it exceeds the threshold levels.

Literature Survey

Researchers all over the world are working on detection and controlling of hazardous gases to minimize the global warming effects. TGS 2442 gas sensor is used to detect carbon dioxide concentration in the work carried out by Zarith Sofia Suraya Bt Hj Bakeri[1] and displays it on to the LCD display. University of Engineering and Technology, Peshawar, Pakistan [2] connected a CO sensor module to a TelosB node and then interface with zigbee wireless connectivity to the central controller which is a high-end PC connected via USB and to the actuator circuit via RS232.

Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia [3], designed a sensor board with

a wireless sensor network node that can autonomously send the recorded data wireless. The sensor board contains two modalities a gas sensor and Pyroelectric Infrared (PIR) sensor. The network is multimodal that used information from the PIR sensor and neighbor nodes to detect the present of gas concentration and modulate the duty cycle of the node.

Proposed Method

The changes occurring in natural phenomenon all around the world like global warming, unusual temperatures at different times during the year, etc. has dangerous gas levels as one of the causes. This work helps to try and minimize hazardous effects of various harmful gases like the carbon monoxide, methane, and alcohol which should not be present in a house or industry or work area. Many people have gas heaters which can release toxic levels of carbon monoxide. This work will be able to keep track of the gas levels of the different gases mentioned above, and if the gases exceed a certain threshold level, it will be indicated by a buzzer and LED and also transferred to a remote place through zigbee or any other communication base module for further control.

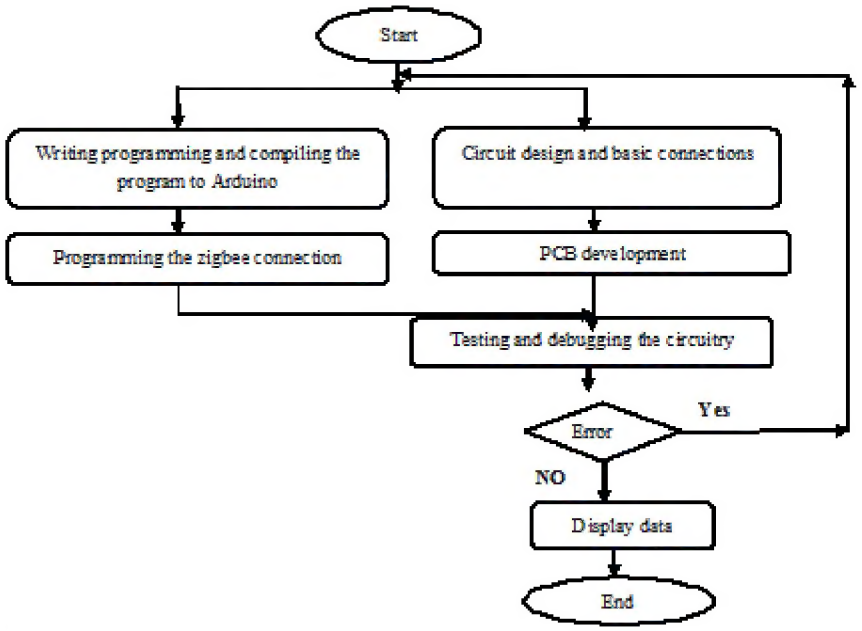

Figure 1: Flow Chart

Figure 1 shows a flow chart indicating the approaching methodology for achieving the objective of the work proposed. The work is divided into two parts which are hardware and software. For the software implementation, it involves writing code and programming the Arduino and zigbee. Meanwhile, hardware implementation involves designing the circuit of the project and PCB development. After both parts were complete the next was the testing and debugging process

Advantages

Some of the benefits of this module are:

- The gas sensors unit can be placed in various places in the building, and hence the entire building can be made secure.
- The base module need not be in line of sight of the sensor module, and can still inform user about the situation.

- The system can be used for various purposes, like for personal use at home, or in a chemistry lab, or industrial use, by just changing the gas threshold levels.
- Up to five different types of gases can be monitored simultaneously.
- System can be modified to detect other gases by just changing the gas sensors.

HARDWARE

Block Diagram

Figure 2 shows the block diagram of module **ONLINE MONITORING AND TRANSFERING OF GEOLOGICAL GASES DATA THROUGH ZIGBEE.** Different sensors like MQ 2, MQ 3, MQ 5, MQ 6, MQ 9 are interfaced with the microcontroller for measuring levels of Carbon monoxide, Carbon dioxide, Methane, Benzine, Isobutane, LPG and Temperature (in degrees). The measured values are transferred to the receiver wirelessly through zigbee module for future control.

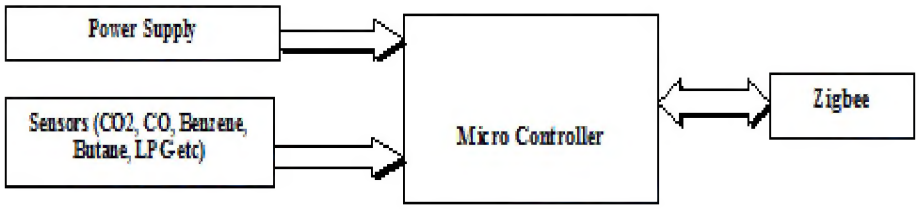

Figure 2: Block Diagram

Microcontroller

The Arduino Uno is a microcontroller board based on the ATmega328. The main characteristics of Arduino uno are:

- 14 Digital input/output pins
- 6 out of 14 pins ca be used as Pulse Width Modulated outputs
- 6 analog inputs
- 16 MHz ceramic resonator
- USB connection
- power jack
- ICSP header
- Reset button.

Sensors

All gas sensors with MQ series works on the principle of an electro-chemical sensor that reacts on sensing the gases with a small heater inside supplied with an external voltage. If a know concentration of gases is know these sensors can be calibrated. The output is an analog signal and can be read with an analog input of the Arduino.

MQ-2

MQ-2 is much sensitive for LPG, Smoke, Methane, Butane, flammable and combustible gases. A 5 volts power supply is required for the heater inside the sensor.

MQ-3

Sensitive for Alcohol, Ethanol, smoke. The heater uses 5V. The MQ303A is an alternative sensor for MQ-3 sensor and works on lower voltage for heater inside the sensor.

MQ-5

Sensitive for Natural gas, LPG. The heater uses 5V.

MQ-6

Sensitive for LPG, butane gas. The heater uses 5V. The MQ306A is like this sensor, but uses a lower heater voltage.

MQ-9

Sensitive for Carbon Monoxide, flammable gasses. The heater uses an alternating voltage of 5V and 1.5V. If only Carbon Monoxide is tested, the heater can be set at 1.5V. The MQ309A is an alternate for MQ9 sensor utilizing a lower voltage for the heater.

Zigbee

A standard wireless mesh network ZigBee is a low-cost, low-power, highly reliable and a reasonably a large range communication device. They are widely deployed in wireless control and monitoring applications. Some of the day-today applications where zigbee can be used are: Home Automation, Smart Energy, Building Automation, Telecommunication Applications, Personal, Home, and Hospital Care and Toys.

Zigbee Coordinator (ZC)

The root of the network tree and the initiator to bridge and connect to the other networks is zigbee coordinator. It is able to store information about the network, including acting as the Trust Centre & repository for security keys.

Zigbee Router (ZR)

As well as running an application function a router can act as an intermediate router, passing data from other devices.

Zigbee End Device (ZED)

Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.

Protocols

Ad-hoc On-demand Distance Vector (AODV) protocol automatically construct a low-speed network of nodes that are ad-hoc in nature. The radios use direct-sequence spread spectrum coding. They can have a transmission range of

10 to 75 meters. Environmental effects also play a essential role in data transmission. The basic channel access mode is "carrier sense, multiple access/collision avoidance" (CSMA/CA). That is, the nodes talk in the same way that people converse; they briefly check to see that no one is talking before they start

Advantages

- Low cost allows the technology to be widely deployed in wireless control and monitoring applications.
- Low power-usage allows longer life with smaller batteries.
- Mesh networking provides high reliability and larger range.

SOFTWARE

Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a run able cyclic executive program:

setup (): A function run once at the start of a program that can initialize settings.

loop (): A function called repeatedly until the board powers off.

Arduino provides following core services and benefits:

- Program Portability
- Modular Programming
- Bit Manipulation
- Polymorphism
- Dynamic Binding
- Message Passing

RESULTS

Gases like Methane, Carbon monoxide, Benzene, LPG, Alocohol, Iso butane can be detected by this gas monitoring kit. Practically it is been tested in a wooden planks manufacturing company named "**ELEGANT PRODUCTS"**. The test results shows that the methane and benzene are detected in which methane has been detected in high percentage due to burning of wood. This high percentage of methane will affect the environment. Suggestion is been given to the corresponding authorities and management of the company to take measures in order to decrease their emission which otherwise are harmful to the human beings. Figure 4 and 5 shows the test results at "Elegant Products" using the gas monitoring kit shown in figure 3.

Figure 3: Gas Monitoring Kit

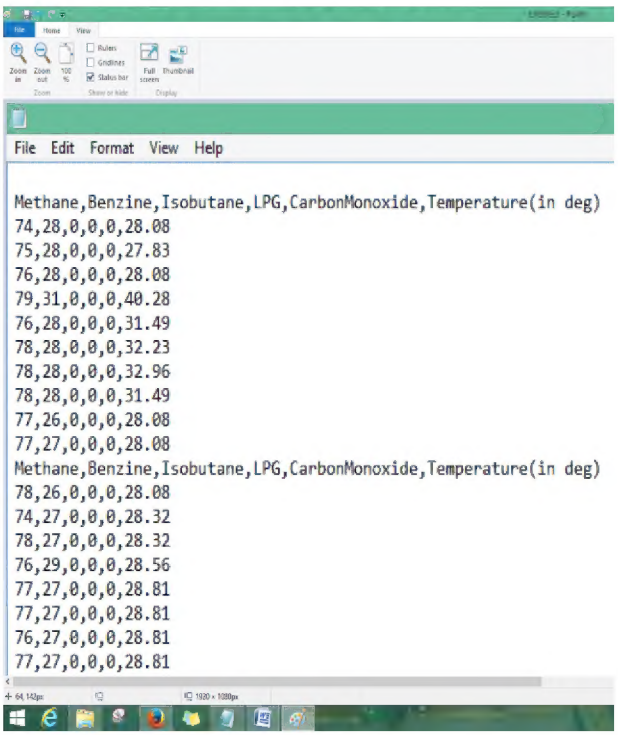

Figure 4: Test Result Analysis Carried at "Elegant Products" Industry

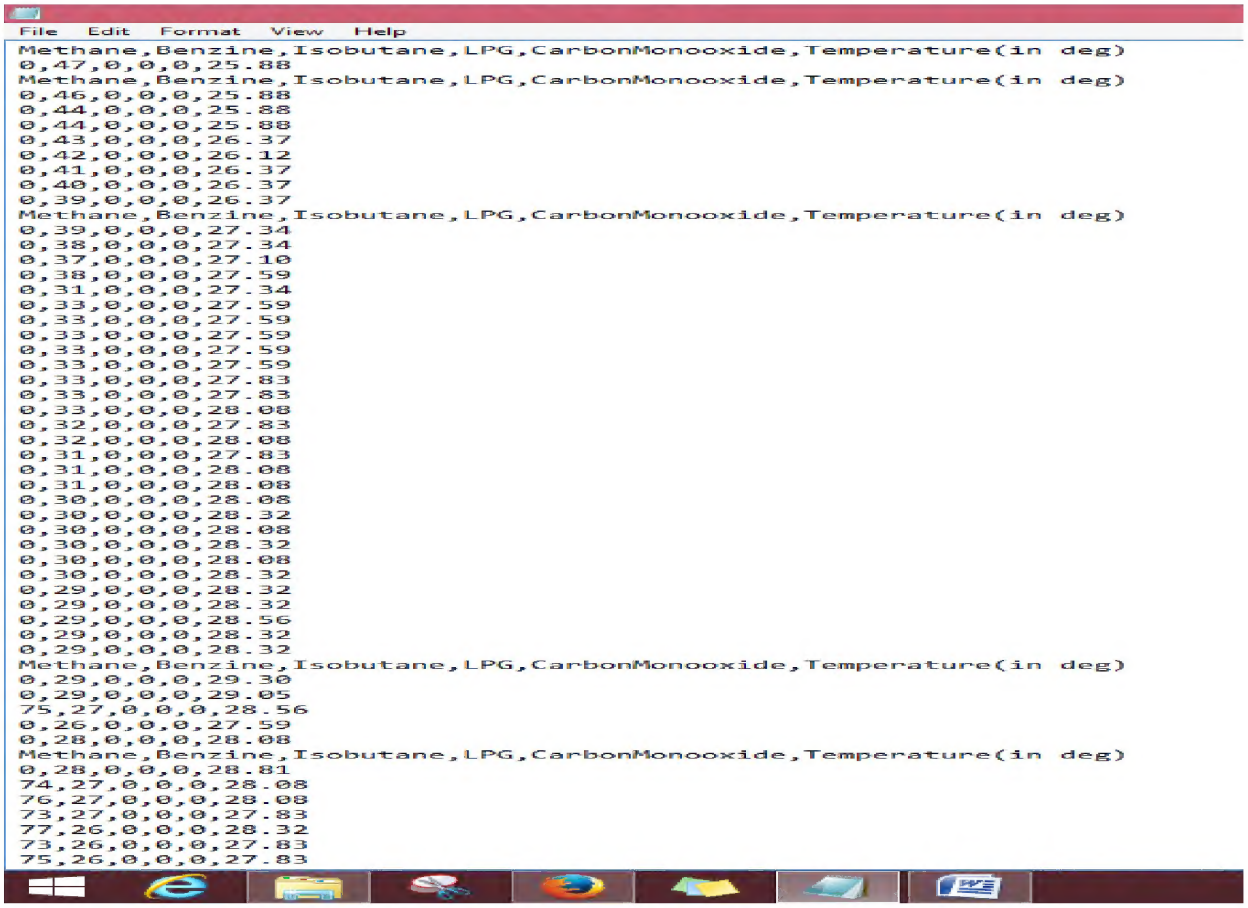

Figure 5: Test Result Analysis Using Gas Monitoring Kit at "Elegant Products"

CONCLUSIONS

This paper describes in detail the design for detecting gases in an Industry or home or work area by indicating through an alarm or LED signals once they exceed an predefined threshold levels. It also shows the implementation procedure for interfacing the zigbee module for remote data transmission of data from field work. This will provide an opportunity for the corresponding authorities to react for the situation thus minimizing the emission of hazardous gases which will otherwise pollute the atmosphere and also the health of human beings.

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This is an acknowledgement of the intensive drive and technical competence of many individuals who have contributed to the success of the project. We specially thank "Elegant Products" industries, *Pedda Amberpet, Hyderabad* for permitting us to carry out the testing process in their industry to obtain the expected results. We also thank them for considering our suggestion to take measures in order to decrease the emission of hazardous gases.

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